

CLAIMS

What is claimed is:

- 1) A method of culturing marine species comprising the steps of:
providing saline water from an inland saline aquifer, the saline water from said aquifer being substantially free of toxic heavy metals and other pollutants;
providing a reservoir to contain the saline water, wherein the saline water in the reservoir has been aerated and allowed to settle to reduce the level iron, copper, manganese zinc and silver in the saline water, thereby producing clarified saline water; and
culturing at least one marine species in a grow out containment area comprising the clarified saline water.
- 2) The method of claim 1 further comprising the step of:
harvesting the at least one marine species or harvesting a useful product extracted from the at least one marine species from the saline water.
- 3) The method of claim 2 further comprising the step of:
purifying said saline water for reuse.
- 4) The method of claim 1, wherein the inland saline aquifer is the Coconino aquifer.
- 5) The method of claim 4, wherein the method does not employ seawater or brine from a salt-water lake.
- 6) The method of claim 4, wherein the step of providing saline water comprises the steps of:
providing higher salinity water from a first part of the aquifer; and
providing lower salinity water from a second part of the aquifer.
- 7) The method of claim 6 further comprising the step of:
adding one or more additional salts to the saline water or clarified saline water such that the salt composition of the saline water or clarified saline water, respectively, approximates the salt composition of natural seawater.
- 8) The method of claim 6, wherein the step of culturing at least one marine species comprises:
culturing at least two different marine species.
- 9) The method of claim 8 further comprising the step of:

adding one or more additional salts to the saline water or clarified saline water such that the salt composition of the saline water or clarified saline water, respectively, approximates the salt composition of natural seawater.

10) The method of claim 4 further comprising the step of:

adding essentially non-saline water to the saline water or clarified saline water to reduce salinity of the same.

11) The method of claim 4, wherein the step of culturing at least one marine species comprises:

culturing at least two different marine species.

12) The method of claim 9, wherein at least one marine species is algae and at least one species is selected from the group consisting of fish, shrimp and shellfish.

13) The method of claim 4, wherein the at least one marine species is selected from the group consisting of microalgae, macroalgae, fish, shrimp and shellfish.

14) The method of claim 4 further comprising the step of:

adding one or more additional salts to the saline water or clarified saline water such that the salt composition of the saline water or clarified saline water, respectively, approximates the salt composition of natural seawater.

15) The method of claim 4, wherein the step of culturing further comprises the step of culturing the at least one marine species in the presence of one or more fertilizers and/or nutrients.

16) The method of claim 4, wherein the saline water or clarified saline water has a composition suitable for aquaculture of one or more marine species.

17) A system for the aquaculture of marine species, the system comprising:

an inland saline water aquifer that provides saline water, after aeration below, having no more than the EPA acceptable levels of toxic heavy metals for drinking water;

at least one aeration tower that promotes the precipitation of undesired metals or metal ions in the saline water thereby forming clarified saline water;

at least one reservoir containing water obtained directly or indirectly from the aquifer;

at least one containment area selected from the group consisting of a pond, tank, raceway, bioreactor, photobioreactor, turbidostat, bag system and tower system, the containment area containing the clarified saline water obtained from the reservoir;

a culture of at least one marine species in the saline water in the at least one containment area;
at least one first processing system for harvesting at least a portion of the culture of the at least one marine species from the saline water thereby forming a harvested marine species mass; and

optionally, at least one second processing system for converting the harvested marine species mass into a usable form (i.e. a powder, tablet or semi-purified algal paste);

optionally, at least one third processing system for extracting at least one useful product from the harvested marine species mass.

18) The system of claim 17, wherein the undesired metals or metal ions comprise iron, copper, manganese zinc and silver.

19) The method of claim 17, wherein at least one second processing system is present.

20) The method of claim 19, wherein the at least one second processing system is adapted for preparing a marine plant material into a usable form

21) The method of claim 19, wherein at least one third processing system is present.

22) The method of claim 17, wherein at least one third processing system is present.

23) The method of claim 22, wherein the at least one third processing system is adapted for extracting a polysaccharide, β -carotene, lutein, astaxanthin, zeaxanthin, docosahexaenoic acid, eicosapentaenoic acid, arachidonic acid, B-phycoerythrin, and/or R-phyococyanin from the useful mass.

24) The method of claim 22, wherein the at least one third processing system is adapted for processing the algae into bio-diesel, methanol or hydrogen fuel.

25) The method of claim 17, wherein the at least one first processing system is adapted for separating a solid from the water.

26) The method of claim 17, wherein the at least one first processing system is adapted for separating a marine plant from the water.

27) The method of claim 17, wherein the at least one first processing system is adapted for separating a marine animal from the water.

28) The method of claim 17 comprising at least two ponds as reservoirs.

- 29) The method of claim 17, wherein the at least one first processing system comprises a constant flow centrifuge or other filtration system that can concentrate a saline solution with 0.05% w/v solids to 25-50% w/v solids.
- 30) The method of claim 17, wherein the useful mass comprises algae.
- 31) The method of claim 17, wherein the containment area is selected from the group consisting of a pond, tank, raceway, bioreactor, photobioreactor, turbidostat, bag system and/or tower system.
- 32) The method of claim 17, wherein the saline aquifer is the Coconino aquifer.
- 33) The method of claim 32, wherein salinity of the saline water obtained from the aquifer varies according to the depth in the aquifer from which the water was obtained.
- 34) The method of claim 32, wherein the saline water is obtained from the aquifer by way of one or more wells.
- 35) The method of claim 32, wherein the saline water after aeration has a salinity in the range of about 16 to 34 ppt.
- 36) The method of claim 17, wherein system is adapted to the culturing of microalgae, macroalgae, fish, shrimp, mollusk and/or shellfish.
- 37) The method of claim 36, wherein the microalgae is selected from the group consisting of *Dunaliella* spp., *Haematococcus* spp., *Porphyridium* spp., *Muriellopsis* spp., *Chlorella* spp., *Chlorococcum* spp., *Tetraselmis* spp., and *Spirulina* spp.; the macroalgae is selected from the group consisting of *Porphyra* spp., *Gracilaria* spp., *Enteromorpha* spp., *Laminaria* spp., *Gelidium* spp., and *Chondrus* spp.; the fish is selected from the group consisting of Salmonidae family, Bothidae family, Pleuronectidae family, and Soleidae family; the shrimp is of the family penaeidae; and/or the shellfish is selected from the group consisting of *Crassostrea* spp., *Ostrea* spp., *Patinopecten* spp., *Argopecten* spp., and *Haliotis* spp.
- 38) The system of claim 17, wherein the useful product is selected from the group consisting of a nutritional supplement, nutraceutical, bio-diesel, methanol and hydrogen fuel.
- 39) The system of claim 17, wherein the system is a closed water-recirculating system.
- 40) The system of claim 17, wherein the system is an open water-replenishment system.
- 41) The method of claim 17, wherein the saline water or clarified saline water has a composition suitable for aquaculture of one or more marine species.